# Step-by-step guide to critiquing research. Part 1: quantitative research

**Michael Coughlan, Patricia Cronin, Frances Ryan**


## Abstract

**When caring for patients it is essential that nurses are using the current best practice. To determine what this is, nurses must be able to read research critically. But for many qualified and student nurses the terminology used in research can be difficult to understand thus making critical reading even more daunting. It is imperative in nursing that care has its foundations in sound research and it is essential that all nurses have the ability to critically appraise research to identify what is best practice. This article is a step-by step-approach to critiquing quantitative research to help nurses demystify the process and decode the terminology.**


**Key words:** Quantitative research ■ Review process ■ Research methodologies

For many qualified nurses and nursing students research is research, and it is often quite difficult to grasp what others are referring to when they discuss the limitations and or strengths within a research study. Research texts and journals refer to critiquing the literature, critical analysis, reviewing the literature, evaluation and appraisal of the literature which are in essence the same thing (Bassett and Bassett, 2003). Terminology in research can be confusing for the novice research reader where a term like 'random' refers to an organized manner of selecting items or participants, and the word 'significance' is applied to a degree of chance. Thus the aim of this article is to take a step-by-step approach to critiquing research in an attempt to help nurses demystify the process and decode the terminology.

When caring for patients it is essential that nurses are using the current best practice. To determine what this is nurses must be able to read research. The adage 'All that glitters is not gold' is also true in research. Not all research is of the same quality or of a high standard and therefore nurses should not simply take research at face value simply because it has been published (Cullum and Droogan, 1999; Polit and Beck, 2006). Critiquing is a systematic method of appraising the strengths and limitations of a piece of research in order to determine its credibility and/or its applicability to practice (Valente, 2003). Seeking only limitations in a study is criticism and critiquing and criticism are not the same (Burns and Grove, 1997). A critique is an impersonal evaluation of the strengths and limitations of the research being reviewed and should not be seen as a disparagement of the researchers ability. Neither should it be regarded as a jousting match between the researcher and the reviewer. Burns and Grove (1999) call this an 'intellectual critique' in that it is not the creator but the creation that is being evaluated. The reviewer maintains objectivity throughout the critique. No personal views are expressed by the reviewer and the strengths and/or limitations of the study and the implications of these are highlighted with reference to research texts or journals. It is also important to remember that research works within the realms of probability where nothing is absolutely certain. It is therefore important to refer to the apparent strengths, limitations and findings of a piece of research (Burns and Grove, 1997). The use of personal pronouns is also avoided in order that an appearance of objectivity can be maintained.

Michael Coughlan, Patricia Cronin and Frances Ryan are Lecturers, School of Nursing and Midwifery, University of Dublin, Trinity College, Dublin

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### Credibility and integrity

There are numerous tools available to help both novice and advanced reviewers to critique research studies (Tanner, 2003). These tools generally ask questions that can help the reviewer to determine the degree to which the steps in the research process were followed. However, some steps are more important than others and very few tools acknowledge this. Ryan-Wenger (1992) suggests that questions in a critiquing tool can be subdivided in those that are useful for getting a feel for the study being presented which she calls 'credibility variables' and those that are essential for evaluating the research process called 'integrity variables'.

Credibility variables concentrate on how believable the work appears and focus on the researcher's qualifications and ability to undertake and accurately present the study. The answers to these questions are important when critiquing a piece of research as they can offer the reader an insight into what to expect in the remainder of the study. However, the reader should be aware that identified strengths and limitations within this section will not necessarily correspond with what will be found in the rest of the work. Integrity questions, on the other hand, are interested in the robustness of the research method, seeking to identify how appropriately and accurately the researcher followed the steps in the research process. The answers to these questions

**Table 1. Research questions - guidelines for critiquing a quantitative research study**

| Elements influencing the believability of the research | |
|---|---|
| **Elements** | **Questions** |
| Writing style | Is the report well written – concise, grammatically correct, avoid the use of jargon? Is it well laid out and organized? |
| Author | Do the researcher(s') qualifications/position indicate a degree of knowledge in this particular field? |
| Report title | Is the title clear, accurate and unambiguous? |
| Abstract | Does the abstract offer a clear overview of the study including the research problem, sample, methodology, finding and recommendations? |
| **Elements influencing the robustness of the research** | |
| **Elements** | **Questions** |
| Purpose/research Problem | Is the purpose of the study/research problem clearly identified? |
| Logical consistency | Does the research report follow the steps of the research process in a logical manner? Do these steps naturally flow and are the links clear? |
| Literature review | Is the review logically organized? Does it offer a balanced critical analysis of the literature? Is the majority of the literature of recent origin? Is it mainly from primary sources and of an empirical nature? |
| Theoretical framework | Has a conceptual or theoretical framework been identified? Is the framework adequately described? Is the framework appropriate? |
| Aims/objectives/ research question/ hypotheses | Have aims and objectives, a research question or hypothesis been identified? If so are they clearly stated? Do they reflect the information presented in the literature review? |
| Sample | Has the target population been clearly identified? How were the sample selected? Was it a probability or non-probability sample? Is it of adequate size? Are the inclusion/exclusion criteria clearly identified? |
| Ethical considerations | Were the participants fully informed about the nature of the research? Was the autonomy/ confidentiality of the participants guaranteed? Were the participants protected from harm? Was ethical permission granted for the study? |
| Operational definitions | Are all the terms, theories and concepts mentioned in the study clearly defined? |
| Methodology | Is the research design clearly identified? Has the data gathering instrument been described? Is the instrument appropriate? How was it developed? Were reliability and validity testing undertaken and the results discussed? Was a pilot study undertaken? |
| Data Analysis / results | What type of data and statistical analysis was undertaken? Was it appropriate? How many of the sample participated? Significance of the findings? |
| Discussion | Are the findings linked back to the literature review? If a hypothesis was identified was it supported? Were the strengths and limitations of the study including generalizability discussed? Was a recommendation for further research made? |
| References | Were all the books, journals and other media alluded to in the study accurately referenced? |

will help to identify the trustworthiness of the study and its applicability to nursing practice.

## Critiquing the research steps

In critiquing the steps in the research process a number of questions need to be asked. However, these questions are seeking more than a simple 'yes' or 'no' answer. The questions are posed to stimulate the reviewer to consider the implications of what the researcher has done. Does the way a step has been applied appear to add to the strength of the study or does it appear as a possible limitation to implementation of the study's findings? (*Table 1*).

## Elements influencing believability of the study

### Writing style

Research reports should be well written, grammatically correct, concise and well organized. The use of jargon should be avoided where possible. The style should be such that it attracts the reader to read on (Polit and Beck, 2006).

### Author(s)

The author(s') qualifications and job title can be a useful indicator into the researcher(s') knowledge of the area under investigation and ability to ask the appropriate questions (Conkin Dale, 2005). Conversely a research study should be evaluated on its own merits and not assumed to be valid and reliable simply based on the author(s') qualifications.

### Report title

The title should be between 10 and 15 words long and should clearly identify for the reader the purpose of the study (Connell Meehan, 1999). Titles that are too long or too short can be confusing or misleading (Parahoo, 2006).

### Abstract

The abstract should provide a succinct overview of the research and should include information regarding the purpose of the study, method, sample size and selection,

the main findings and conclusions and recommendations (Conkin Dale, 2005). From the abstract the reader should be able to determine if the study is of interest and whether or not to continue reading (Parahoo, 2006).

## Elements influencing robustness

### Purpose of the study/research problem

A research problem is often first presented to the reader in the introduction to the study (Bassett and Bassett, 2003). Depending on what is to be investigated some authors will refer to it as the purpose of the study. In either case the statement should at least broadly indicate to the reader what is to be studied (Polit and Beck, 2006). Broad problems are often multi-faceted and will need to become narrower and more focused before they can be researched. In this the literature review can play a major role (Parahoo, 2006).

### Logical consistency

A research study needs to follow the steps in the process in a logical manner. There should also be a clear link between the steps beginning with the purpose of the study and following through the literature review, the theoretical framework, the research question, the methodology section, the data analysis, and the findings (Ryan-Wenger, 1992).

### Literature review

The primary purpose of the literature review is to define or develop the research question while also identifying an appropriate method of data collection (Burns and Grove, 1997). It should also help to identify any gaps in the literature relating to the problem and to suggest how those gaps might be filled. The literature review should demonstrate an appropriate depth and breadth of reading around the topic in question. The majority of studies included should be of recent origin and ideally less than five years old. However, there may be exceptions to this, for example, in areas where there is a lack of research, or a seminal or all-important piece of work that is still relevant to current practice. It is important also that the review should include some historical as well as contemporary material in order to put the subject being studied into context. The depth of coverage will depend on the nature of the subject, for example, for a subject with a vast range of literature then the review will need to concentrate on a very specific area (Carnwell, 1997). Another important consideration is the type and source of literature presented. Primary empirical data from the original source is more favourable than a secondary source or anecdotal information where the author relies on personal evidence or opinion that is not founded on research.

A good review usually begins with an introduction which identifies the key words used to conduct the search and information about which databases were used. The themes that emerged from the literature should then be presented and discussed (Carnwell, 1997). In presenting previous work it is important that the data is reviewed critically, highlighting both the strengths and limitations of the study. It should also be compared and contrasted with the findings of other studies (Burns and Grove, 1997).

### Theoretical framework

Following the identification of the research problem and the review of the literature the researcher should present the theoretical framework (Bassett and Bassett, 2003). Theoretical frameworks are a concept that novice and experienced researchers find confusing. It is initially important to note that not all research studies use a defined theoretical framework (Robson, 2002). A theoretical framework can be a conceptual model that is used as a guide for the study (Conkin Dale, 2005) or themes from the literature that are conceptually mapped and used to set boundaries for the research (Miles and Huberman, 1994). A sound framework also identifies the various concepts being studied and the relationship between those concepts (Burns and Grove, 1997). Such relationships should have been identified in the literature. The research study should then build on this theory through empirical observation. Some theoretical frameworks may include a hypothesis. Theoretical frameworks tend to be better developed in experimental and quasi-experimental studies and often poorly developed or non-existent in descriptive studies (Burns and Grove, 1999). The theoretical framework should be clearly identified and explained to the reader.

### Aims and objectives/research question/ research hypothesis

The purpose of the aims and objectives of a study, the research question and the research hypothesis is to form a link between the initially stated purpose of the study or research problem and how the study will be undertaken (Burns and Grove, 1999). They should be clearly stated and be congruent with the data presented in the literature review. The use of these items is dependent on the type of research being performed. Some descriptive studies may not identify any of these items but simply refer to the purpose of the study or the research problem, others will include either aims and objectives or research questions (Burns and Grove, 1999). Correlational designs, study the relationships that exist between two or more variables and accordingly use either a research question or hypothesis. Experimental and quasi-experimental studies should clearly state a hypothesis identifying the variables to be manipulated, the population that is being studied and the predicted outcome (Burns and Grove, 1999).

### Sample and sample size

The degree to which a sample reflects the population it was drawn from is known as representativeness and in quantitative research this is a decisive factor in determining the adequacy of a study (Polit and Beck, 2006). In order to select a sample that is likely to be representative and thus identify findings that are probably generalizable to the target population a probability sample should be used (Parahoo, 2006). The size of the sample is also important in quantitative research as small samples are at risk of being overly representative of small subgroups within the target population. For example, if, in a sample of general nurses, it was noticed that 40% of the respondents were males, then males would appear to be over represented in the sample, thereby creating a sampling error. The risk of sampling

errors decrease as larger sample sizes are used (Burns and Grove, 1997). In selecting the sample the researcher should clearly identify who the target population are and what criteria were used to include or exclude participants. It should also be evident how the sample was selected and how many were invited to participate (Russell, 2005).

### Ethical considerations

Beauchamp and Childress (2001) identify four fundamental moral principles: autonomy, non-maleficence, beneficence and justice. Autonomy infers that an individual has the right to freely decide to participate in a research study without fear of coercion and with a full knowledge of what is being investigated. Non-maleficence implies an intention of not harming and preventing harm occurring to participants both of a physical and psychological nature (Parahoo, 2006). Beneficence is interpreted as the research benefiting the participant and society as a whole (Beauchamp and Childress, 2001). Justice is concerned with all participants being treated as equals and no one group of individuals receiving preferential treatment because, for example, of their position in society (Parahoo, 2006). Beauchamp and Childress (2001) also identify four moral rules that are both closely connected to each other and with the principle of autonomy. They are veracity (truthfulness), fidelity (loyalty and trust), confidentiality and privacy. The latter pair are often linked and imply that the researcher has a duty to respect the confidentiality and/or the anonymity of participants and non-participating subjects.

Ethical committees or institutional review boards have to give approval before research can be undertaken. Their role is to determine that ethical principles are being applied and that the rights of the individual are being adhered to (Burns and Grove, 1999).

### Operational definitions

In a research study the researcher needs to ensure that the reader understands what is meant by the terms and concepts that are used in the research. To ensure this any concepts or terms referred to should be clearly defined (Parahoo, 2006).

### Methodology: research design

Methodology refers to the nuts and bolts of how a research study is undertaken. There are a number of important elements that need to be referred to here and the first of these is the research design. There are several types of quantitative studies that can be structured under the headings of true experimental, quasi–experimental and non–experimental designs (Robson, 2002) (*Table 2*). Although it is outside the remit of this article, within each of these categories there are a range of designs that will impact on how the data collection and data analysis phases of the study are undertaken. However, Robson (2002) states these designs are similar in many respects as most are concerned with patterns of group behaviour, averages, tendencies and properties.

### Methodology: data collection

The next element to consider after the research design is the data collection method. In a quantitative study any number of strategies can be adopted when collecting data and these can include interviews, questionnaires, attitude scales or observational tools. Questionnaires are the most commonly used data gathering instruments and consist mainly of closed questions with a choice of fixed answers. Postal questionnaires are administered via the mail and have the value of perceived anonymity. Questionnaires can also be administered in face-to-face interviews or in some instances over the telephone (Polit and Beck, 2006).

### Methodology: instrument design

After identifying the appropriate data gathering method the next step that needs to be considered is the design of the instrument. Researchers have the choice of using a previously designed instrument or developing one for the study and this choice should be clearly declared for the reader. Designing an instrument is a protracted and sometimes difficult process (Burns and Grove, 1997) but the overall aim is that the final questions will be clearly linked to the research questions and will elicit accurate information and will help achieve the goals of the research. This, however, needs to be demonstrated by the researcher.

**Table 2. Research designs**

| Design | Sample | Sample allocation | Features | Outcome |
|---|---|---|---|---|
| Experimental | 2 or more groups | Random | • Groups get different treatments | • Cause and effect relationship |
| Quasi-experimental | One or more groups | Random | • One variable has not been manipulated or controlled (usually because it cannot be) | • Cause and effect relationship but less powerful than experimental |
| Non-experimental, e.g. descriptive and includes: cross-sectional, correlational, comparative, longitudinal studies | One or more groups | Not applicable | • Discover new meaning<br>• Describe what already exists<br>• Measure the relationship between two or more variables | • Possible hypothesis for future research<br>• Tentative explanations |

If a previously designed instrument is selected the researcher should clearly establish that chosen instrument is the most appropriate. This is achieved by outlining how the instrument has measured the concepts under study. Previously designed instruments are often in the form of standardized tests or scales that have been developed for the purpose of measuring a range of views, perceptions, attitudes, opinions or even abilities. There are a multitude of tests and scales available, therefore the researcher is expected to provide the appropriate evidence in relation to the validity and reliability of the instrument (Polit and Beck, 2006).

### Methodology: validity and reliability

One of the most important features of any instrument is that it measures the concept being studied in an unwavering and consistent way. These are addressed under the broad headings of validity and reliability respectively. In general, validity is described as the ability of the instrument to measure what it is supposed to measure and reliability the instrument's ability to consistently and accurately measure the concept under study (Wood et al, 2006). For the most part, if a well established 'off the shelf' instrument has been used and not adapted in any way, the validity and reliability will have been determined already and the researcher should outline what this is. However, if the instrument has been adapted in any way or is being used for a new population then previous validity and reliability will not apply. In these circumstances the researcher should indicate how the reliability and validity of the adapted instrument was established (Polit and Beck, 2006).

To establish if the chosen instrument is clear and unambiguous and to ensure that the proposed study has been conceptually well planned a mini-version of the main study, referred to as a pilot study, should be undertaken before the main study. Samples used in the pilot study are generally omitted from the main study. Following the pilot study the researcher may adjust definitions, alter the research question, address changes to the measuring instrument or even alter the sampling strategy.

Having described the research design, the researcher should outline in clear, logical steps the process by which the data was collected. All steps should be fully described and easy to follow (Russell, 2005).

### Analysis and results

Data analysis in quantitative research studies is often seen as a daunting process. Much of this is associated with apparently complex language and the notion of statistical tests. The researcher should clearly identify what statistical tests were undertaken, why these tests were used and what were the results. A rule of thumb is that studies that are descriptive in design only use descriptive statistics, correlational studies, quasi-experimental and experimental studies use inferential statistics. The latter is subdivided into tests to measure relationships and differences between variables (Clegg, 1990).

Inferential statistical tests are used to identify if a relationship or difference between variables is statistically significant. Statistical significance helps the researcher to rule out one important threat to validity and that is that the result could be due to chance rather than to real differences in the population. Quantitative studies usually identify the lowest level of significance as $P \leq 0.05$ ($P$ = probability) (Clegg, 1990).

To enhance readability researchers frequently present their findings and data analysis section under the headings of the research questions (Russell, 2005). This can help the reviewer determine if the results that are presented clearly answer the research questions. Tables, charts and graphs may be used to summarize the results and should be accurate, clearly identified and enhance the presentation of results (Russell, 2005).

The percentage of the sample who participated in the study is an important element in considering the generalizability of the results. At least fifty percent of the sample is needed to participate if a response bias is to be avoided (Polit and Beck, 2006).

### Discussion/conclusion/recommendations

The discussion of the findings should flow logically from the data and should be related back to the literature review thus placing the study in context (Russell, 2002). If the hypothesis was deemed to have been supported by the findings, the researcher should develop this in the discussion. If a theoretical or conceptual framework was used in the study then the relationship with the findings should be explored. Any interpretations or inferences drawn should be clearly identified as such and consistent with the results.

The significance of the findings should be stated but these should be considered within the overall strengths and limitations of the study (Polit and Beck, 2006). In this section some consideration should be given to whether or not the findings of the study were generalizable, also referred to as external validity. Not all studies make a claim to generalizability but the researcher should have undertaken an assessment of the key factors in the design, sampling and analysis of the study to support any such claim.

Finally the researcher should have explored the clinical significance and relevance of the study. Applying findings in practice should be suggested with caution and will obviously depend on the nature and purpose of the study. In addition, the researcher should make relevant and meaningful suggestions for future research in the area (Connell Meehan, 1999).

### References

The research study should conclude with an accurate list of all the books, journal articles, reports and other media that were referred to in the work (Polit and Beck, 2006). The referenced material is also a useful source of further information on the subject being studied.

## Conclusions

The process of critiquing involves an in-depth examination of each stage of the research process. It is not a criticism but rather an impersonal scrutiny of a piece of work using a balanced and objective approach, the purpose of which is to highlight both strengths and weaknesses, in order to identify

whether a piece of research is trustworthy and unbiased. As nursing practice is becoming increasingly more evidenced based, it is important that care has its foundations in sound research. It is therefore important that all nurses have the ability to critically appraise research in order to identify what is best practice. BJN


Bassett C, Bassett J (2003) Reading and critiquing research. *Br J Perioper Nurs* **13**(4): 162–4

Beauchamp T, Childress J (2001) *Principles of Biomedical Ethics.* 5th edn. Oxford University Press, Oxford

Burns N, Grove S (1997) *The Practice of Nursing Research: Conduct, Critique and Utilization.* 3rd edn. WB Saunders Company, Philadelphia

Burns N, Grove S (1999) *Understanding Nursing Research.* 2nd edn. WB Saunders Company, Philadelphia

Carnell R (1997) Critiquing research. *Nurs Pract* **8**(12): 16–21

Clegg F (1990) *Simple Statistics: A Course Book for the Social Sciences.* 2nd edn. Cambridge University Press, Cambridge

Conkin Dale J (2005) Critiquing research for use in practice. *J Pediatr Health Care* **19:** 183–6

Connell Meehan T (1999) The research critique. In: Treacy P, Hyde A, eds. *Nursing Research and Design.* UCD Press, Dublin: 57–74

Cullum N, Droogan J (1999) Using research and the role of systematic reviews of the literature. In: Mulhall A, Le May A, eds. *Nursing Research: Dissemination and Implementation.* Churchill Livingstone, Edinburgh: 109–23-

Miles M, Huberman A (1994) *Qualitative Data Analysis.* 2nd edn. Sage, Thousand Oaks, Ca

Parahoo K (2006) *Nursing Research: Principles, Process and Issues.* 2nd edn. Palgrave Macmillan, Houndmills Basingstoke

Polit D, Beck C (2006) *Essentials of Nursing Care: Methods, Appraisal and Utilization.* 6th edn. Lippincott Williams and Wilkins, Philadelphia

Robson C (2002) *Real World Research.* 2nd edn. Blackwell Publishing, Oxford

Russell C (2005) Evaluating quantitative research reports. *Nephrol Nurs J* **32**(1): 61–4

Ryan-Wenger N (1992) Guidelines for critique of a research report. *Heart Lung* **21**(4): 394–401

Tanner J (2003) Reading and critiquing research. *Br J Perioper Nurs* **13**(4): 162–4

Valente S (2003) Research dissemination and utilization: Improving care at the bedside. *J Nurs Care Quality* **18**(2): 114–21

Wood MJ, Ross-Kerr JC, Brink PJ (2006) *Basic Steps in Planning Nursing Research: From Question to Proposal* 6th edn. Jones and Bartlett, Sudbury


## KEY POINTS

- Many qualified and student nurses have difficulty understanding the concepts and terminology associated with research and research critique.
- The ability to critically read research is essential if the profession is to achieve and maintain its goal to be evidenced based.
- A critique of a piece of research is not a criticism of the work, but an impersonal review to highlight the strengths and limitations of the study.
- It is important that all nurses have the ability to critically appraise research in order to identify what is best practice.